

Jan. 21, 1930.

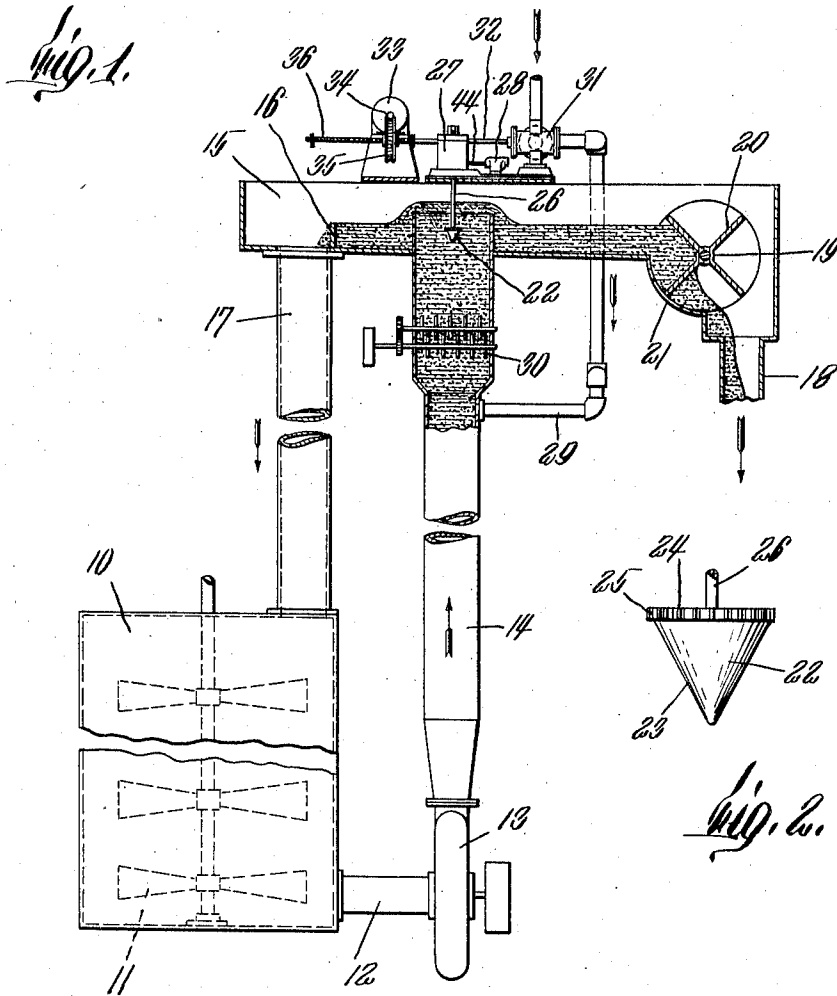
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1,744,145

PULP STOCK TONNAGE REGULATOR

Filed Oct. 25, 1928

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3.

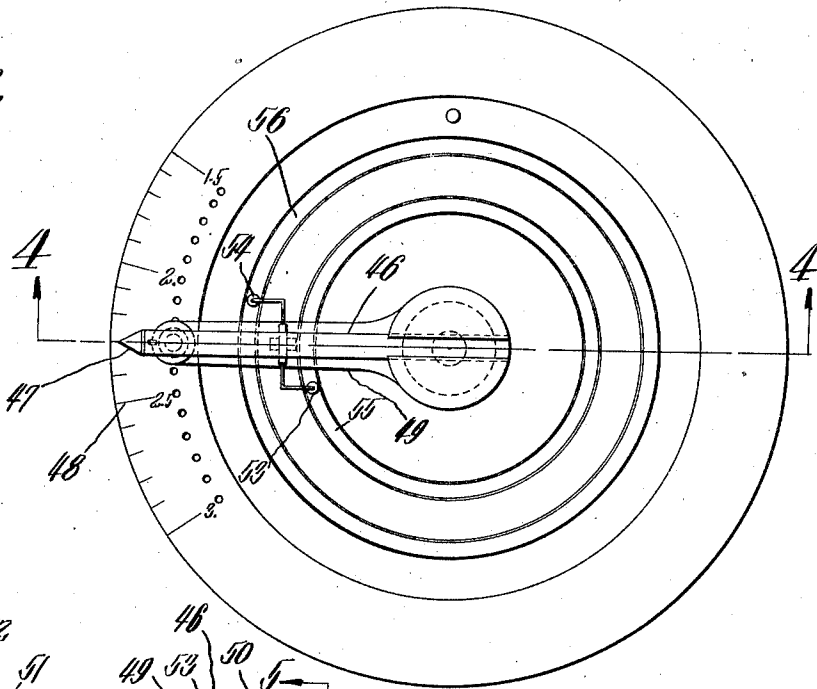
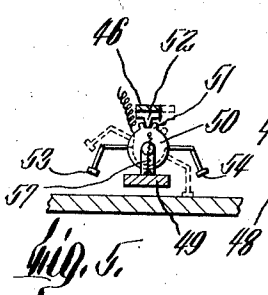


Fig. 5.

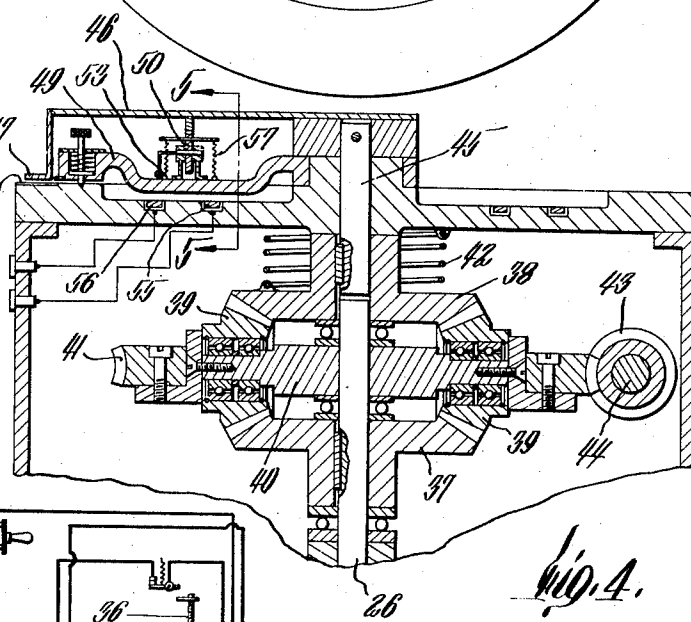


Fig. 4.

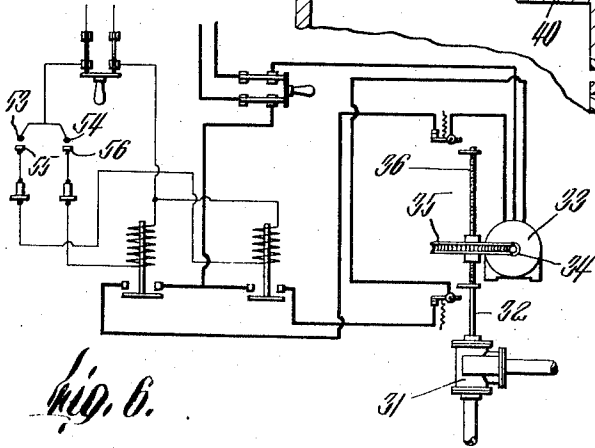


Fig. 6.

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PULP-STOCK-TONNAGE REGULATOR

Application filed October 25, 1928. Serial No. 314,901.

This invention relates to apparatus for accurately regulating the rate of delivery of a constituent of fluent material. More specifically, the invention relates to apparatus capable of being used in a pulp mill wherein cellulosic pulp is suspended in water, and the suspension is fed through the mill in one or more streams, these streams passing various points where the pulp is subjected to successive treatments required to obtain the ultimate desired product. Some of the treatments involve the addition of chemical substances which in many cases must be accurately proportioned to the quantity of pulp in the suspension. Hence it is essential that the tonnage, or rate of delivery of dry weight of stock, be accurately known. This involves two factors, namely, the rate of delivery of the pulp stock, or aqueous suspension of the pulp, and the consistency of the stock, that is, the ratio of the dry weight of the pulp to the weight of the water in which it is suspended. The effective regulation of the consistency of pulp stock and the feeding of pulp stock in measured quantities or at measured rates present difficulties owing to the peculiar characteristics of such stock at the concentrations customarily employed in mill practice. This is especially true when the pulp has had little or no beating. Such pulp stock in some respects behaves more like a plastic than a liquid so that considerable difficulty has been experienced heretofore in regulating its consistency and rate of feed or delivery. According to the present invention, I provide automatic apparatus which reliably and efficiently delivers a stock of substantially uniform consistency at a uniform rate, thus feeding the pulp itself at a uniform rate, the apparatus being capable of successful operation on pulp of any degree of "freeness" and stock of any concentration within the range of ordinary mill practice. This is accomplished by constantly measuring the viscosity of the supply stream of stock, automatically diluting the supply in response to such measurement to a desired predetermined consistency, then metering the diluted stock accurately at a predetermined rate.

For a more complete understanding of the

invention, reference may be had to the following description of an embodiment thereof and to the drawings, of which,

Figure 1 is a diagrammatic representation of apparatus embodying the invention.

Figure 2 is an elevation of one of the working parts of the apparatus.

Figure 3 is a plan view of apparatus for controlling the consistency of the stock.

Figure 4 is a fragmentary section on the line 4-4 of Figure 3.

Figure 5 is a section on the line 5-5 of Figure 4.

Figure 6 is a wiring diagram showing how the consistency regulating apparatus may be connected.

Referring to the drawings in detail, 10 represents a stock tank to which pulp stock may be supplied from the beaters or any other suitable source. The stock is preferably mixed and agitated by a set of revolving blades 11. From the tank 10 stock may be taken as through a pipe 12 and fed by a centrifugal pump 13 or other suitable means upwardly through a penstock 14 which, as shown, is preferably in a vertical position. The upper end of the penstock, as shown, opens into a suitable container 15, the penstock being open at its end so that the pulp stock ascending therethrough will spill over the edges into the container 15. In order to maintain a pool of desired depth in the container I may provide a suitable barrier or dam 16 over which excess pulp may spill into a return pipe 17 which leads back to the tank 10. Suitably located near one end of the tank I provide a metering mechanism for feeding stock from the pool to an outlet pipe 18 at any desired rate. This metering mechanism, which is described and claimed in my copending application Serial No. 306,674, filed September 18, 1928, may comprise a paddle wheel 19 having a number of paddles 20 and preferably mounted to revolve on a horizontal axis. An arcuate wall 21 is arranged to extend from the bottom floor of the receptacle 15 to the discharge pipe 18, this arcuate wall being concentric with the axis of the wheel 19 and being extended over a sufficient arc to be capable of simultaneous en-

gagement with two of the paddles 20. As shown in Figure 1 of the drawing, the axis of the paddle wheel 19 is approximately level with the bottom floor of the container 15. The level of pulp maintained in the container may be regulated according to the consistency of the pulp but ordinarily should not be higher than the upper limit of the wheel 19.

In order to maintain the pulp stock entering the container 15 at a substantially constant consistency, that is, a substantially constant percentage of dry weight of pulp to a given quantity of stock, I may mount automatically regulating apparatus responsive to a rotatable member 22 which may project downwardly into the open end of the penstock 14 so as to be in direct contact with the stream of pulp stock flowing upwardly through the penstock into the container 15. Apparatus of this type is described and claimed in my copending application, Serial No. 306,674, filed September 18, 1928. The feeler member 22 may be of any desired shape suitable for the purpose an example being illustrated in Figure 2. This form comprises a conical portion 23 surmounted by a relatively short cylindrical portion 24, on the periphery of which portion are a number of short, outwardly extending blades 25. The feeler 22 is preferably mounted on a shaft 26 which extends downwardly from apparatus usually indicated at 27, this apparatus being automatically responsive to changes of resistance to rotation on the part of the feeler 22. A suitable motor 28 may be provided to drive the feeler 22 at a substantially constant rate. The resistance of the feeler 22 to rotation when in contact with the pulp stock will depend on the viscosity of the stock since the action of the blades 25 of the feeler is to entrain portions of the stock in the stream which is ascending through the penstock and to move these portions of pulp stock against the fluid friction of the non-rotating stock contiguous thereto. The greater the viscosity of the material, the greater will be the resistance offered to the rotation of the feeler 22. In ordinary mill practice the stock supplied from the beaters for further treatment is customarily of substantially uniform "slowness", that is, the stock from the beaters is supplied to the tank 10 at a substantially uniform degree of hydration so that there is little variation of viscosity arising from non-uniformity of "slowness". The effect of temperature changes is in the case of pulp stock of the concentrations usually maintained in mill practice negligible so that in the present case the viscosity of the stock supplied to the tank 10 depends almost entirely upon its consistency. This consistency is subject to occasional changes of considerable magnitude. It is essential, however, that the stock entering the container 15 be of substantially uniform consistency so that when it is meas-

ured out by the rotation of the paddle wheel 19, not only will the quantity of stock be accurately known, but also the dry weight of the pulp in the stock. This is essential for the proper treatment of the stock in further steps of processing. In order to maintain the pulp in the container 15 at a substantially uniform consistency, the pulp in the tank 10 is preferably at a thicker consistency than that desired for further treatment. In order to thin or dilute this stock to the desired consistency I may add water thereto, as by a pipe 29 which, as shown in Figure 1, enters the penstock 14 at any convenient point. Between the point of entry of the pipe 29 and the upper end of the penstock 14 I provide a suitable stirring apparatus 30 capable of mixing thoroughly the diluting water with the stock. This diluted stock at once flows into contact with the feeler 22 so that a quick response to changes in viscosity is thus obtained. In order to control the supply of water entering the penstock through the supply pipe 29, I may insert in the pipe 29 a suitable valve 31 which may be opened and closed as by a valve stem 32. The operation of the valve 31 is automatically controlled by the mechanism 27, this mechanism in the embodiment herein illustrated operating through a suitable motor 33, a worm 34 and a worm gear 35 to reciprocate the valve stem 32. In order to effect such reciprocation the worm gear 35 may be held against axial movement and may be screw threaded on a threaded portion 36 of the stem 32, rotation of the wheel 35 thus resulting in a reciprocation of the stem 32 which is normally held against rotation.

The operation of the mechanism as a whole is as follows: Pulp stock is pumped out through the penstock 14 and is suitably diluted by water entering through the pipe 29, this water being thoroughly mixed with the pulp by stirrers 30. The diluted pulp then comes in contact with the feeler 22 which is driven by the motor 28. If the resistance of the feeler to rotation changes from a predetermined value, the mechanism 27 operates automatically to open or close the valve 31, thus increasing or decreasing the water supplied through the pipe 29. This quickly restores the pulp to the desired consistency. The pulp of uniform consistency which is fed into the container 15 is measured out by the paddle wheel 19 and discharged through the pipe 18 to any suitable point in the mill for further treatment. Excess pulp spills over the dam 16 and is returned to the tank 10 to be recirculated through the penstock 14.

Suitable apparatus for regulating the consistency of the stock fed into the container 15 is illustrated in Figures 3 to 6, this apparatus per se not being a part of the invention herein claimed. The shaft 26 which carries the feeler 22 may, as shown in Figure 4, be keyed to a bevel gear wheel 37. A similar

gear wheel 38 may be mounted opposite the gear 37, the two being operatively connected by a series of pinions 39 mounted on a disk 40 to which is secured a worm gear 41. The upper gear 38 is resiliently held against rotation, as by a suitable spring 42 one end of which may be secured to the gear wheel 38, the other end being secured to the housing of the apparatus 27. The worm gear 41 is driven by a worm 43 mounted on a shaft 44 which is directly connected to the motor 28. The motor 28 is preferably rotated at a substantially constant speed so that the gear 41 is likewise driven at a constant speed. If the gear 38 is held against rotation, the pinions 39 will travel on the gear 38 and by their rotation will cause a rotation of the gear 37 and the shaft 26. As a result of this structure any opposition to rotation of the feeler 22 will result in torque being impressed on the gear 38. This torque is resiliently opposed by the spring 42 which permits a limited angular movement of the gear 38, the angle of turn being substantially proportional to the resistance of the feeler to rotation, that is, to the torque impressed on the feeler in order to maintain the rotation of it.

In order to facilitate observation of the angle of turn of the gear 38, I may fix thereto a short shaft 45 which, as shown in Figure 4, may project upwardly through the casing of the mechanism and may have thereon a radially extending indicator arm 46 having an index 47 adapted to cooperate with suitable scale markings 48 on the casing or other stationary portion of the apparatus. This scale may be calibrated as desired to indicate the percentage of consistency or any other values.

In order to provide automatic regulating means for maintaining the incoming pulp at a substantially constant consistency I may provide an adjustable arm 49 on which may be mounted a suitable disk 50 having a pair of gear teeth 51 adapted to engage a single tooth 52 mounted on the under side of the arm 46. A pair of electrical contact members 53 and 54 are attached to the disk 50 and are adapted for alternative contact with a pair of metallic rings 55 and 56, respectively. When the arm 46 is directly over the arm 49, as shown in Figure 5, the contact members 53 and 54 are both held out of contact with their respective rings. If, however, the arm 46 swings in one direction or the other, the disk 50 is turned so as to permit the member 53 or 54 to come into contact with its ring, thus closing an electric circuit as shown in Figure 6 which actuates a relay by which, in turn, current is supplied to the motor 33 to turn the gear wheel 35 and thus to move the valve stem 32, altering the rate of supply of diluting water through the pipe 29 to the pulp in the penstock 14. In order to ensure a good electrical contact between the members 53 and

54 and their respective rings a suitable spring 57 may be stretched from the arm 49 to a point on the disk 50 above its axis of rotation as shown in Figure 5. If the disk is rotated off center, the spring will tend to continue the rotation until one of the contact members has reached its ring, whereupon the spring will maintain a good electrical contact between the member and its ring.

I claim:

1. Apparatus of the class described comprising a receptacle for pulp stock having an inlet port and an outlet port, a feeler supported in said inlet port, means responsive to the contact of said feeler with stock entering the tank for automatically diluting the stock to a substantially uniform consistency prior to its entry into the tank, and means associated with said outlet port for feeding stock from the tank at a predetermined rate.

2. Apparatus of the class described comprising a receptacle for pulp stock having an inlet port through the bottom thereof and an outlet port, means for feeding stock out of the tank through said outlet port at a predetermined rate, a member movable in said inlet port in contact with stock entering the tank, means for diluting the stock prior to its entry into the tank, and means including said movable member for automatically controlling said diluting means in response to changes of viscosity in the stock.

3. Apparatus of the class described comprising a receptacle for pulp stock, a stock tank, a penstock leading from said tank upwardly through the bottom of said receptacle and opening into said receptacle, an overflow pipe leading from said receptacle to said tank, means including a barrier in said receptacle between said penstock and said overflow pipe for maintaining a predetermined level of stock in said receptacle, means for supplying water to said penstock, means for mixing the water supplied to the penstock with the pulp flowing therethrough, a rotatable member supported in the stream of stock entering the receptacle, means for rotating said member, means responsive to the resistance of said member to rotating for automatically regulating the supply of water to the penstock whereby a substantially constant stock consistency is maintained, and means for feeding stock out of said receptacle at a predetermined rate.

In testimony whereof I have affixed my signature.

MILTON O. SCHUR.